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ABSTRACT

An exploratory, comparative study of the achievement of 186 homogeneously and heterogeneously grouped second graders found no significant differences in overall achievement in reading and mathematics. However, a significant difference in reading comprehension scores of children in the two groups was found. At low, medium, and high academic performance levels, homogeneously grouped second graders scored significantly higher in reading comprehension than did heterogeneously grouped students. Children in homogeneous classes also exhibited significantly higher amounts of time-on-task than did children in heterogeneous classes. No difference across groups was found in time-on-task for high level children. If grouped homogeneously, low-achieving and middle-achieving children spent significantly more time-on-task. Time-on-task of second graders in homogeneous groups correlated significantly with their achievement in both reading and mathematics. This relationship was not observed for children in the heterogeneous groups. Among children grouped heterogeneously, but not homogeneously, preferences for auditory-visual learning stimuli were correlated with reading and mathematics achievement. Structure as a preferred learning style was negatively correlated with achievement in mathematics for children taught in homogeneous groups. Responsibility as a learning style was correlated with reading achievement for children taught in heterogeneous groups. Implications of the findings are discussed. (RH)

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DIFFERENCES IN ACHIEVEMENT AND TIME-ON-TASK WITH HOMOGENEOUS AND HETEROGENEOUS ABILITY GROUPING OF SECOND GRADERS

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Grouping students homogeneously for reading instruction is a common practice in the United States. Students are usually grouped homogeneously to facilitate instruction. Homogeneous groups, according to Leinhardt (1980), are usually sequentially designated as high, middle, and low. The rationale for ability grouping typically is predicated on the premise that some students are much more scholastically advanced and learn more rapidly than others. Hence, as noted by Strike (1983), ability grouping supposedly compensates for different rates of learning and complements various educational needs and learning styles.

Revived interest in research activities associated with ability grouping has resulted from recent legal and social challenges to local school districts. Though the impact of grouping practices on cognitive and affective behaviors of students has been explored rather thoroughly, the effects of grouping on variables such as time-on-task and learning style preferences of children as related to achievement are only minimally known. Knowledge of these relationships is particularly important for school districts seeking to implement better management practices.

In theory, homogeneously grouped classes consist of students whose performances tend to cluster close to the measure of central tendency. Appropriate instruction might enhance the performance of certain individuals within the groups, thus increasing variability and personifying individual differences. According to Drowatzky (1981) contributions to this phenomenon might be made by variables of problem solving

ability, rate of forgetting, learning rate and style and motivation.

Advocates of ability grouping claim that homogeneously grouped students are easier to teach because teachers have fewer individual student differences with which to contend. Those opposed to ability grouping criticize the practice because it tends to place students in "ingroups" and "outgroups." If perceived from the latter perspective, ability grouping does not facilitate better learning for all groups but, instead, lends credibility to those in the fast tracks while often stigmatizing those in the low groups (Kulik & Kulik, 1982).

Nichols (1979) noted that some educators view ability grouping as a viable means of coping with the instructional needs of children for whom compensation has been made for differences in motivation, learning style, readiness and aptitude. Haskins, Walden and Raney (1985), however, reported that the achievement of low-income and minority students may be impeded when classroom assignments are made on the basis of I.Q. scores, standardized test scores, teacher recommendations, or any combination of these variables.

Rist (1970) claimed that sometimes students are grouped based on manifestations of middle class teacher perceptions such as appearance and deportment. Often teachers see lower class children as being less able. So what may really transpire is that children become sociologically stratified. A possible concomitant of these perceptions is that teachers

might offer these students in the higher groups a more stimulating and challenging curriculum than that provided for students in the lower groups. Rist (1970) also asserted that grouping patterns really lend themselves to the creation of dichotomies in the cognitive achievement of children.

Eder (1981) concluded that bright students tend to perform better in schools where ability-grouping is utilized than in schools where students are not grouped according to ability. However, slower students tend to perform not as well in ability-grouped schools than in schools without ability grouping. Students taught in lower level reading groups were instructed in environments less conducive to learning. Students in higher groups were instructed in environments having fewer disruptions and stronger teacher expectations.

Productive time-on-task is one of the most important variables related to school achievement (Stallings, 1980). Lower groups, as noted by Eder (1981), are likely to have more inattentive behavior because often students who are immature are placed in lower groups. The lack of attending on the part of these students may affect the behavior of their peers negatively, thus generating further inattention. Consequentially, the experience of being in the low group can be radically different from being in the high group. It is quite possible that different instructional strategies influence both process and product. Time-on-task, according to Stallings (1980), is certainly important, but the quality of that time's use is of greater importance.

THE RESEARCH PROBLEM

This exploratory research sought first to determine whether a difference existed for achievement means in second graders grouped homogeneously as compared to those grouped heterogeneously. The study also explored whether an interaction associated with grouping patterns and prior achievement levels of students in explaining current achievement scores for these students. In addition, this research also attempted to identify and/or explore differences in time-on-task for each achievement level group taught in heterogeneous and homogeneous classes. A final facet of the study was to see if significant differences existed in the relationship between time-on-task and learning style variables for students as compared to the achievement of the students taught in homogeneous and heterogeneous groups, respectively.

The principal reasons for formulating this study were to test the following null hypotheses:

1. No significant differences will result from comparing overall achievement means in the areas of reading and mathematics for second graders taught in the two grouping patterns.
2. No significant differences will result in means of respective subtest scores in the areas of reading, mathematics and listening for second graders taught in heterogeneous and homogeneous groups.

3. Within each achievement level group, no significant difference in achievement means will exist for second graders taught in the two grouping patterns.
4. No significant difference will be identified in time-on-task exhibited by second graders in homogeneously and heterogeneously grouped classrooms.
5. Within each of the low, medium and high achievement groups, no significant difference in time-on-task will result for second graders taught in homogeneous and heterogeneous groups.
6. No significant differences will result in the correlations between overall achievement in reading and mathematics and the variables of time-on-task and learning styles for second graders taught in homogeneous and heterogeneous groups.

METHOD

The Research Design: An Overview

The research design of this study was a randomized posttest-only comparison group design. Dependent variables consisted of measures of achievement in reading and mathematics as assessed by the subscales of the Stanford Achievement Test, Primary Battery, and time-on-task determinations made by classroom observers. In addition to homogeneous and heterogeneous grouping practice, other independent variables whose relationship to student achievement considered were learning styles and prior achievement levels of students.

Subjects. Subjects were of 186 second graders in eight self-contained classrooms. The 330 second grade students enrolled in a school housing both first and second grades in a university town in East-Central Mississippi were stratified into low, medium and high achievement groups on the basis of their achievement scores in reading at the end of first grade the previous year. The low achievement group placed at or below the 25th percentile in reading achievement according to national norms. The middle achievement group scored higher than the 25th percentile and lower or at the 75th percentile in reading achievement. The high achievement group scored above the 75th percentile in reading achievement prior to entry to second grade. The children, after this stratification according to level, were randomly assigned to either homogeneous or heterogenous classroom groups. The resulting eight classroom groups consisted of two heterogeneous groups, two lower achieving homogeneous groups, two middle achieving homogeneous groups and two high achieving homogeneous groups.

The eight teachers participating in the study were randomly selected from a group of 13 second grade teachers who were randomly assigned to the eight groups of children.

Treatment. After being assigned randomly to the heterogeneous and homogeneous groups as described, the children were taught reading and mathematics as outlined in the school's curriculum guide, using the same materials and instructional schedules for all groups. A two hour block of time daily was

spent in reading instruction and one hour was allocated for instruction in mathematics for all groups.

Instrumentation and Data Collection. Early in the school year the Learning Style Inventory-Primary Version (Perrin, 1977) was administered to the children to assess their preferred learning style relative to physical, sociological, emotional and environmental factors. Physical environmental variables included the individual's perceptual preferences (auditory, visual, tactile, kinesthetic), need for intake (food, water), time of day and mobility. Sociological stimuli reflected the individual's ability to learn most effectively when he or she worked alone, with peers, with one person, as part of a team, with an adult, or in a varied group of peers and adults. Emotional elements of learning style included motivation, persistence, responsibility and structure. Environment accounted for four elements: sound, light, temperature, and room design. Internal reliability coefficients of the 16 learning style measures in this instrument ranged from .49 to .87.

During the first two months of the study trained observers determined the average time-on-task exhibited by individual children in each respective classroom. An observer visited each classroom at least three times and systematically recorded on-task behaviors of individual children for a 30 minute time interval. Every five minutes the observer systematically recorded whether each child was "on-task" or "off-task." The percentage of on-task observations were then computed. This

procedure was repeated for each of the three observations. The total on-task percentages for each student was then determined by computing the average on-task percentages for the three visits.

The Stanford Achievement Test Battery, Primary 2, Form E, was administered in April to determine students' achievement. Seven of the scores derived from these data were used as criterion variables. These scale scores were in the areas of achievement in vocabulary, reading comprehension, total reading, math computations, math concepts and problems, total mathematics and total listening. Internal reliability coefficients for these achievement scales, as reported by the Psychological Corporation (1985), test publishers, ranged from .89 for total listening to .97 for total reading.

Methods of Data Analysis. Multivariate analysis of variance (Nie, Hall, et al., 1975) and one way analysis of variance statistical models were used to determine differences in achievement and time-on-task performances for the two groups.

Multivariate analysis of variance was used to compare the two groups students (homogeneously and heterogeneously grouped) on total reading and total mathematics scores. As part of this analysis, univariate or analysis of variance was conducted on each of the two variables independently.

Separate ANOVAs were conducted on scores from each of the subtests of the Stanford as well as on the percentage of time-on-task.

Separate ANOVAs were conducted on each of the scores from the Stanford and for the percentage of time-on-task for each of the three achievement-level groups comparing the reading and mathematics performance of students receiving instruction in the homogeneous groups and with those taught in the heterogeneous groups.

RESULTS

To secure an overall comparison of the achievement for the homogeneously and heterogeneously grouped students in total reading and total mathematics, achievement means for these two measures were compared through use of a multivariate analysis of variance statistical model. These data are cited in Table 1. No significant differences at the .05 level existed between the two groups in either overall reading achievement or overall mathematics achievement or in these two measures considered as a composite variable in the MANOVA analysis. These data failed to reject the hypothesis that no difference in overall achievement existed between second graders taught in homogeneous and heterogeneous groups. A much smaller standard deviation, however, was noted for the students taught reading in heterogeneous groups (47.0) than for those taught the same subject in homogeneous groups (113.9) These data were entirely unexpected since other investigators, such as Drowatzky (1981) have reported the reverse. Students homogeneously grouped, in theory, should cluster closely to the mean.

Table 1

Comparison of Achievement in Mathematics and Reading for Homogeneously and Heterogeneously Grouped Second Graders

Achievement Criteria	Homogeneous			Heterogeneous			df	F
	N	$\bar{X}$	SD	N	$\bar{X}$	SD		
Total Reading	139	558.4	113.9	48	569.2	47.0	1,185	.40
Total Mathematics	139	564.4	118.5	48	552.9	122.7	1,185	.33
Total Set							2,184	2.11

In testing the second hypothesis, means for the heterogeneous group and the homogeneous group on each of the achievement measures indicated by the subscales of the Stanford Achievement Test, Primary Battery were compared through use of analysis of variance. As noted in Table 2, a significant difference in achievement in reading comprehension was the only difference in the two groups on all achievement measures. Second graders in homogeneous groups scored significantly higher on this measure than did their counterparts taught in heterogeneous groups. Data revealed no differences in achievement in any of the mathematical subscales or in the area of listening.

Differences in achievement of the homogeneous and heterogeneous groups in reading comprehension and in other achievement areas were measured by the subtests of the Stanford Battery within the low, medium and high academic groups. Data found by testing the third hypothesis appear on Tables 3, 4 and 5. It is noted that significant differences also existed in reading comprehension achievement for homogeneously- and heterogeneously-grouped second graders, regardless of whether they were working at low, medium or high academic levels. Students classified as low academic achievers who were taught in homogeneous groups achieved significantly higher in reading comprehension than did their academic counterparts who were taught in heterogeneous classes. The same differences existed in the achievement in reading comprehension for middle level achievers and for high level achievers. Again, no significant

Table 2

Comparison of Achievement and Time-on-Task of Homogeneously and Heterogeneously Grouped Second Graders in Subskill Areas

Achievement Criteria	Homogeneous			Heterogenous			df	F
	N	$\bar{X}$	SD	N	$\bar{X}$	SD		
Reading Comprehension	139	557.4	114.8	48	494.3	157.4	1,185	8.82*
Vocabulary	139	564.4	118.5	48	552.9	122.7	1,185	.32
Math Computation	139	548.6	118.1	48	541.9	96.3	1,185	.12
Math Concepts & Problems	139	547.5	117.8	48	541.9	89.4	1,185	.09
Listening	139	572.0	118.7	48	559.4	123.3	1,185	.40
Time-on-Task	139	81.1	11.5	48	74.5	18.6	1,185	8.20*

*$p < .01$

Table 3

Comparison of Achievement and Time-on-Task for Upper Performance Level Second-Graders Grouped Homogeneously and Heterogeneously

	Homogeneous			Heterogeneous				
Criteria	N	$\bar{X}$	SD	N	$\bar{X}$	SD	df	F
Reading Comprehension	49	625.9	99.77	14	529.5	228.2	1,61	5.34*
Vocabulary	49	614.6	97.1	14	572.0	167	1,61	1.48
Total Reading	49	630.1	100.2	14	620.5	36.6	1,61	.12
Math Computation	49	600.2	94.8	14	558.8	166.9	1,61	1.43
Math Concepts & Problems	49	608.1	99.2	14	555.0	163.1	1,61	1.88
Total Mathematics	49	599.9	94.2	14	549.9	160.8	1,61	2.18
Listening	49	618.7	96.6	14	580.2	169.1	1,61	1.20
Time-on-Task	49	79.9	13.4	14	78.5	12.7	1,61	.12

*$p < .05$

Table 4

Comparison of Achievement and Time-on-Task for Middle Performance Level Second-Graders Grouped Homogeneously and Heterogeneously

	Homogeneous			Heterogeneous				
Criteria	N	$\bar{X}$	SD	N	$\bar{X}$	SD	df	F
Reading Comprehension	48	553.9	40.7	23	523.7	86.3	1,69	4.03*
Vocabulary	48	556.5	89.8	23	547.9	122.4	1,69	.12
Total Reading	48	548.8	32.6	23	563.3	30.2	1,69	3.69
Math Computation	48	547.5	91.4	23	548.1	46.2	1,69	.01
Math Concepts & Problems	48	532.6	85.8	23	545.1	25.9	1,69	.46
Total Mathematics	48	542.7	87.8	23	539.5	20.6	1,69	.03
Listening	48	469.2	90.5	23	552.5	122.1	1,69	.42
Time-on-Task	48	80.8	10.9	23	71.1	25.0	1,69	5.27*

*$p < .05$

Table 5

Comparison of Achievement and Time-on-Task for Lower Performance Level Second-Graders Grouped Homogeneously and Heterogeneously

	Homogeneous			Heterogeneous				
Criteria	N	$\bar{X}$	SD	N	$\bar{X}$	SD	df	F
Reading Comprehension	41	493.4	117.7	11	387.8	127.6	1,50	6.75*
Vocabulary	41	527.3	123.0	11	539.1	25.2	1,50	.10
Total Reading	41	497.5	116.1	11	516.1	26.4	1,50	.28
Math Computation	41	501.5	120.1	11	507.5	30.1	1,50	.02
Math Concepts & Problems	41	511.6	120.6	11	518.5	26.6	1,50	.04
Total Mathematics	41	505.9	118.1	11	509.8	17.9	1,50	.01
Listening	41	533.5	124.0	11	542.2	25.1	1,50	.13
Time-on-Task	41	83.0	9.4	11	76.7	8.34	1,50	4.09*

*$p < .05$

differences were found in the achievement of homogeneously grouped and heterogeneously grouped children on any of the other achievement areas studied, when the groups were subdivided according to achievement level.

In testing the fourth hypothesis, a significant difference (.01 level) was also found in time-on-task between the second graders who were grouped homogeneously and heterogeneously. Those grouped homogeneously were on-task for 81.1% of the observed time, while those grouped heterogeneously were on-task for an average of only 74.5% of the time. These data are given in Table 2. In further exploration of differences in time-on-task for homogeneous and heterogeneous groups, hypothesis five was tested. The children were subdivided into low, medium and high achievement groups. Then, differences in time-on-task were computed for the two grouping patterns within each of the achievement level groups. Results of these analyses are given in Tables 3, 4, and 5. No significant differences were found in time-on-task percentages between the homogeneously and heterogeneously grouped children who were placed in the high or upper academic group. In the middle group, however, significant differences (.05 level) occurred. As indicated by Table 4, the children homogeneously grouped were on-task 80.8% of the time, while those in heterogeneous groups were on-task 71.1% of the time. The same type of difference in time-on-task was discovered within the lower achieving group. Homogeneously grouped

children who were classified as the lower achievers were on-task 83% of the time, while their heterogeneously grouped counterparts were on-task only 76.7% of the time. See Table 5.

An investigation was made of difference in the relationship between achievement in reading and mathematics and children's time-on-task and learning styles in the environments of homogeneous groups and heterogeneous groups, respectively. These relationships relative to achievement in overall reading are cited in Table 6. Within the homogeneously-grouped setting, variables of time-on-task and preference for learning in bright, well-lighted areas were variables which correlated significantly with achievement in reading. In contrast, these two variables did not correlate significantly with achievement for children grouped heterogeneously. Responsibility and perceptual preferences, on the other hand, correlated significantly (.05 level) with reading achievement for children taught in heterogeneous groups. These latter variables did not relate to reading achievement for children in homogeneous groups.

In studying significant differences in the relationship between reading achievement and variables of time-on-task and learning styles for the children in the two grouping patterns, a Fisher r to Z transformation was made for each of the correlation coefficients. Then, a z ratio was computed to determine if there were differences significant at the .05 level. Data on Table 6 show that only two of the learning styles related differently to reading achievement in the two grouping patterns. Light as a preferred environmental learning

Table 6

Correlation of Learning Styles and Time-on-Task with Achievement in Reading in Two Groups

Criteria	Homogeneous Group r	Heterogeneous Group r	z ratio
Time-on-Task	.24*	-.02	1.53
Light	.23*	-.12	2.05*
Sound	-.19	-.05	1.41
Temperature	-.08	.04	.71
Design	.13	-.14	1.59
Intake	-.13	.16	1.71
Structure	-.16	.09	1.47
Sociological	.08	.02	.59
Time	.11	-.07	1.06
Responsibility	-.04	.20*	1.41
Mobility	.10	-.04	.82
Motivation	.01	-.09	.59
Perceptual	.04	.33*	2.18*

*Significant at .05 level

factor correlated significantly higher for the homogeneous group (r=.23) than it did for the heterogeneous group (-.12). Also, perceptual preferences for auditory-visual oriented learning styles (as opposed to tactile, kinesthetic) of second graders in heterogeneous groups correlated more with achievement in reading than this same learning style pattern correlated with achievement with children in homogeneous groups. The sixth null hypothesis, therefore, was not supported. Data in this analysis illustrated that two learning styles did relate differently to children's achievement in reading when they are grouped homogeneously and heterogeneously.

Correlations of the time-on-task and learning style variables with achievement in mathematics for the second graders are cited in Table 7. Within the heterogeneous group, only one learning style, perceptual preferences, correlated significantly with children's achievement in mathematics. In the homogeneous group, the time-on-task measures correlated positively with achievement. One learning style, structure, correlated negatively (-.24) with achievement in mathematics. No differences were found in these relationships in the homogeneous and heterogeneous groups, as shown by none of the z-ratios reaching 1.96, the value needed for significance at the .05 level. These data show that children in heterogeneous groups with a perceptual preference for auditory-visual stimuli learned better in mathematics. Also, second graders with less preference for structure in learning learned more in mathematics in the homogeneously grouped classrooms. Also, in the

Table 7

Correlation of Learning Styles and Time-on-Task with Achievement in Mathematics in Two Groups

Criteria	Homogeneous Group r	Heterogeneous Group r	z ratio
Time-on-Task	.21*	-.05	1.28
Light	.15	-.16	1.84
Sound	-.16	.00	.95
Temperature	-.05	.09	.83
Design	.11	.02	.76
Intake	-.10	.11	.06
Structure	-.24*	.02	1.53
Sociological	.13	-.03	.95
Time	.07	.18	1.48
Responsibility	-.04	.02	.35
Mobility	.06	.05	.65
Motivation	-.02	.00	.12
Perceptual	-.03	.24*	1.59

homogeneous groups, time-on-task correlated significantly (.05 level) in a positive manner with achievement of the second graders in mathematics.

SUMMARY OF RESULTS

Data in this study show that there was no significant difference in overall achievement in reading and mathematics for second graders taught in homogeneous and heterogeneous groups. A significant difference in achievement in reading comprehension for children in the two groups did result. At each of the low, medium and high academic performance levels, second graders in homogeneously grouped classrooms scored significantly higher in achievement in reading comprehension than did their achievement level counterparts in heterogeneously grouped classes. Children in homogeneous classes also exhibited significantly higher amounts of time-on-task than did children in heterogeneous classes. There was no difference, however, in time-on-task for high achievement level children studying in the two different grouping patterns. Both low achieving and middle achieving children stayed on-task significantly more if they were grouped homogeneously than if grouped heterogeneously. Time-on-task of second graders in homogeneous groups correlated significantly with their achievement in both reading and mathematics. This relationship was not observed for children in the heterogeneous groups. Preferences for auditory-visual learning stimuli were correlated with achievement in both reading and mathematics for children taught in heterogeneous groups, but not for children in homogeneous

groups. Structure as a preferred learning style was negatively correlated with achievement in mathematics for children taught in homogeneous groups. Responsibility as a learning style was correlated with reading achievement for children taught in heterogeneous groups. These data show that learning styles and time-on-task data relate differently to achievement when children are taught by different grouping patterns.

DISCUSSION

There did not appear to be any overall differences in achievement in reading and mathematics when test scores for second grade children were homogeneously or heterogeneously grouped. These data generally confirm previous findings by other investigators relative to this issue. Differences, however, were found in the sub-achievement area of reading comprehension, with those in the homogeneous groups scoring higher than children in the heterogeneous groups in each of the low, medium and high levels.

The achievement area of reading comprehension is associated with mastery of higher order thinking skills. It would be more difficult in heterogeneously grouped classes to challenge appropriately children working both in the upper quartile and in the lower quartile achievement levels. It was especially interesting to note that children in the lower achievement group scored higher in comprehension when grouped homogeneously than did their academic peers in heterogeneous classrooms. Previous studies have noted that children placed academically in the upper quartile who studied in homogeneous groups

achieved higher than their counterparts in heterogeneous classes, but this finding was not noted for the lower ability group.

Rationale for encouraging heterogeneous grouping in the past has been that children, in general, achieve just as well as they do in homogeneous groups; and, if there is a slight difference in achievement favoring children in homogeneous groups, that difference is nullified by the potential development of negative development of attitudes when ability grouping is practiced. The results of this study support that contention in part; but there is also a strong indication that heterogeneous grouping may not promote the development of concepts requiring high order thinking skills as well as the alternative grouping pattern. Since this study involved only the participation of eight teachers, it may be that the specific teachers involved may not have planned lessons which developed the reading comprehension skills to their maximum potential in the heterogeneously grouped classes; but this variable requires further study. If subsequent studies with more and different teachers confirm that children achieve better in reading comprehension in homogeneously grouped classes, then special grouping will be recommended for the second graders for at least part of their instruction.

Time-on-task was promoted by grouping practices also. Lower achieving children and middle achievers both stayed on-task better in homogeneous groups than in heterogeneous groups. Further, the percentage of time-on-task for children in

the heterogeneous groups was significantly correlated with their overall achievement in both reading and mathematics. Since time-on-task is the best current predictor of achievement, it is understandable how that the homogeneous group did better in achievement in reading comprehension.

Though the meaning of the differential in correlations of learning style variables is not entirely clear at this time, different learning styles do predict achievement in homogeneous and heterogeneous groups. It also appears that different learning style conditions predict achievement in reading than in mathematics. However, regarding desirable room conditions, students in heterogeneous groups who achieved higher in both mathematics and reading preferred to study in well-lighted, cheery rooms. This room variable was not related to achievement for the homogeneous groups. Perceptual preferences for visual-auditory stimuli in learning, rather than tactile, kinesthetic preferences, were positively related to the heterogeneous group members' reading achievement scores. Auditory and visual perceptual preferences are generally associated with readiness for reading; hence it was expected that these learning styles would be associated with reading achievement. It is not clear why these preferences are better predictors of achievement in heterogeneous groups than in homogeneous. Though learning styles, in general, did not relate very well to achievement in either the homogeneous or heterogeneous groups of second graders, this area of study warrants further investigation.

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